The question is often asked "Why do I have to wait to fly after diving"? The answer to the question is simply "pressure". Consider the surface as the baseline and at this level we all have one atmosphere of weight on us (without us even noticing it!). For every 33 feet of sea water (10 m.) we descend-add another atmosphere to the pressure. This pressure causes nitrogen to go into solution in our blood and our plasma becomes supersaturated.

The opposite is true for ascending to altitude with a decrease in pressure. It is the decrease in pressure that causes nitrogen to come out of solution and to bubble (like opening a bottle of carbonated beverage which is under pressure and in which CO2 is under pressure).

So, we get bubbles when we:

1. Ascend to the surface after a dive
2. Ascend to altitude after a dive (a continuance of the dive while flying)
3. Ascend to a high altitude from the surface without pressurization.

Therefore we need to allow a longer time to blow off saturated nitrogen after diving (the same reason we spend a designated time on the surface between dives).
Altitude Specifics

5000 feet (1524 m.)- Up to this altitude pressure decreases approximately 1 inch of mercury for every 1000 feet. Beyond this altitude, the decrease per 1000 feet gradually diminishes.

5000 feet (1524 m.)- Oxygen breathing at this altitude will improve night vision.

8000 feet (2438 m.)- This is the maximum cabin altitude permitted by the FAA in commercial airliners. Airline passengers may not be subjected to pressures exceeding this.

10,000 feet (3048 m.)- According to Air Force rules, oxygen breathing is mandatory starting at this altitude in unpressurized aircraft.

18,000 feet (5486 m.)- Atmospheric pressures are 1/2 normal at this altitude.

23,000 feet (7010 m.)- Decompression sickness can occur starting at this altitude but is usually minor. The Lear Jet is capable of flying at a maximum altitude of 23,000 feet (7010 m.) while maintaining a pressure cabin altitude of sea level.

30,000 feet (9144 m.)- Atmospheric pressures 1/4 of normal. Severe decompression sickness can occur at this altitude.

40,000 feet (12192 m.)- This is the limit for oxygen breathing by mask on a demand system. The total air pressure at this altitude is less than 140 mmHg.

42,000 feet (12802 m.)- This is the FAA certified ceiling for the Boeing 727, 707 and the Douglas DC 8 Airliners.

45,000 feet (13716 m.)- This is the absolute limit for oxygen breathing using a positive pressure oxygen mask with 15 mm. positive pressure. Breathing at this altitude can only be sustained by a trained athlete for a few minutes.
45,100 feet (13747 m.)- This is the FAA certified ceiling for the Boeing 747.

50,000 feet (15240 m.)- The airman has 6 to 7 seconds useful consciousness after losing cabin pressure at this altitude. A pressure suit or a pressure cabin is necessary for survival.

63,000 feet (19202 m.)-(Armstrong's Line) Blood at 37 degrees C. (98.6 F.) boils at 63,000 feet as the vapor pressure of water at that temperature is 47 mmHg. 47mmHg is the total atmospheric pressure at 63,000 feet (19202 m.).

The FAA specifies that pressurize aircraft be certified for a maximum differential pressure across the pressure cabin of 9.4 PSI. Most commercial airlines have a house rule that pressure cabin differentials will not exceed 8.6 PSI.

The Undersea and Hyperbaric Medical Society conducted a workshop on flying after diving in 1991 after their controversial recommendations were made in 1989 and this was supported by DAN and diver certification agencies in their publications. Some diving groups were pleased, others felt they were too conservative and unnecessarily constrictive to recreational divers.

The final upshot of the debate is a DAN revised guideline which states:

a. A minimum surface interval of 12 hours is required before ascent in a commercial aircraft (8000 foot (2438 m.) cabin).

b. Wait an extended surface interval beyond twelve hours after daily, multiple dives for several days or dives that require decompression stops

c. The greater the diving the longer the duration recommended before diving.

The above is for sports diving and should not apply to commercial diving or nitrox diving. Because of the complex nature of DCS and because decompression
schedules are based on unverifiable assumptions, there can never be a fixed flying after diving rule that can guarantee prevention of bends completely.

Reference

Vann RD, Denoble P, Emmerman MN, Corson KS Flying after diving and decompression sickness. Aviat Space Environ Med 64 (9 Pt 1): 801-807 (Sep 1993)

Reports of 1,159 decompression sickness (DCS) incidents during recreational diving were analyzed by logistic regression for the effects of flying on the occurrence of Type II DCS, complete relief of symptoms after one recompression, and residual symptoms 3 months after treatment. The relevant diver populations were those who: 1) did not fly; 2) had symptoms before flying but flew anyhow; 3) and did not have symptoms before flying but developed symptoms during or after flight. Of the total DCS population, 13.9% had preflight symptoms while 5.6% developed symptoms during or after flight. Symptoms which occurred during or after flight were no more serious and their responses to recompression no less successful than symptoms in nonflying divers. There was a statistically significant association between divers who flew with pre-existing symptoms and Type II DCS, incomplete relief with one recompression, and residual symptoms after 3 months.

Flying after diving (commercial)

Commercial diving requires another (but similar) set of rules.

Here are the recommendations for flying after diving produced by the Diving Medical Advisory Committee of the UHMS, 1989: (for commercial diving)

Time before diving at cabin altitudes
<table>
<thead>
<tr>
<th>AIR DIVING</th>
<th>CABIN</th>
<th>ALTITUDES</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. No-stop dives</td>
<td>2 hours</td>
<td>4 hours</td>
<td>Total time under pressure less than 60 min in last 12 hours</td>
</tr>
<tr>
<td>b. All other air dives</td>
<td>12 hours</td>
<td>12 hours</td>
<td>&lt; 4 hours under pressure</td>
</tr>
<tr>
<td>c. Air or Nitrox Saturation</td>
<td>24 hours</td>
<td>48 hours</td>
<td>&gt; 4 hours under pressure</td>
</tr>
<tr>
<td>MIXED GAS DIVING</td>
<td>12 hours</td>
<td>12 hours</td>
<td>At least 12 hours following return to atmospheric pressure after heliox, trimix bounce and saturation diving.</td>
</tr>
</tbody>
</table>

When You are Too Sick to Fly

The Commission On Emergency Medical Services of the American Medical Association has published a list of several medical conditions which may make it...
dangerous for you to fly. Most of the dangers arise because of:

- the reduced cabin air pressure
- the lowered oxygen content of the air in the cabin
- the motion of the plane
- the stress of traveling
- the unavailability of adequate medical treatment if something should go wrong.

Among the more prominent items on the list.

- Severe high blood pressure or heart disease, particularly if you've had a heart attack within 30 days or a stroke within 14 days.
- Pneumothorax (air outside the lung).
- Cysts of the lung or severe lung disease.
- Acute sinusitis or middle ear infections.
- Abdominal surgery within 14 days, acute diverticulitis or ulcerative colitis, acute esophageal virices or acute gastroenteritis.
- Severe anemia, sickle cell disease (above 22,500 feet/6858 m.) or hemophilia with active bleeding.
- Recent eye surgery.
- Wired jaws.
- Pregnancy beyond 240 days (or less if threatened miscarriage).
- Epilepsy (unless medically controlled and cabin air pressure is below 8,000 feet).
- Recent skull fracture.
- Brain tumors.
- Violent and unpredictable behavior.

If you have any doubt as to whether you should be traveling, consult your doctor.

This strategy is from "The Airline Passenger's Guerrilla Handbook," by George Albert Brown.